REDESIGNATION REQUEST AND MAINTENANCE PLAN

KNOXVILLE, TENNESSEE NONATTAINMENT AREA
1997 ANNUAL $PM_{2.5}$ NAAQS

(ANDERSON, BLOUNT, KNOX, LOUDON, AND PARTIAL ROANE COUNTIES)

DATE--DRAFT

PREPARED BY:

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Acronyms

AEO	Annual Energy Outlook
APCD	Air Pollution Control Division
ALM	Aircraft, Locomotive, and Commercial Marine
CAA	Clean Air Act
CFR	Code of Federal Regulations
DVMT	Daily Vehicle Miles Traveled
EIS	Emissions Inventory System
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Agreement
FGD	Flue Gas Desulfurization system
FR	Federal Register
FRM	Federal Reference Method
HPMS	Highway Performance Monitoring System
MOVES	EPA's onroad mobile source emissions factor model
MVEB	Motor Vehicle Emissions Budget
NAAQS	National Ambient Air Quality Standard
NAICS	North American Industrial Classification System
NEI	National Emissions Inventory
NH_3	Ammonia
NO_x	Nitrogen Oxides
$PM_{2.5}$	Fine Particulates
ppb	parts per billion
ppm	parts per million
SCC	Source Classification Code
SCR	Selective Catalytic Reduction system
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TDEC	Tennessee Department of Environment and Conservation
TDM	Travel Demand Model
TDOT	Tennessee Department of Transportation
tpd	Tons per day
tpy	Tons per year
TPO	Transportation Planning Organization
TVA	Tennessee Valley Authority
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

Appendices

EXECUTIVE SUMMARY

The Knoxville, Tennessee $PM_{2.5}$ nonattainment area includes part of Roane County (the area included in 2000 census block group 47-145-0307-2) and all of Anderson, Blount, Knox and Loudon counties. Air quality monitoring at several sites within this region between 2001 and 2003, indicated that particulate concentrations exceeded the 15.0 micrograms per cubic meter ($\mu g/m^3$) National Ambient Air Quality Standard (NAAQS). Subsequently, the Environmental Protection Agency (EPA) designated the area as nonattainment for the 1997 annual $PM_{2.5}$ NAAQS effective January 5, 2005. More recently, air quality monitoring data for 2013 through 2015 indicates declining particulate concentrations in the Knoxville area, and the design value at the controlling monitor shows attainment of the 1997 annual $PM_{2.5}$ NAAQS.

Tennessee is petitioning EPA for re-designation of the Knoxville nonattainment area to attainment for the 1997 annual NAAQS, based on an attaining three-year design value for the period 2013-2015. This petition is submitted pursuant to §107(d)(3) of the Clean Air Act (CAA), which specifies the requirements for re-designation of nonattainment areas, as well as §172(c)(3) and §189(a)(1) of the CAA.

This petition will show that the Knoxville nonattainment area has attained the National Ambient Air Quality Standard and that the observed reduction in fine particulate levels is due to permanent and enforceable emission reductions at the Federal, State, and local levels. In addition, an emissions inventory is included, which indicates declining emissions of NO_X, SO_2, and VOC between 2014 and 2028, although ammonia emissions are expected to increase slightly. As emissions of these $PM_{2.5}$ precursors continue to decline, the region is likely to remain in attainment of the NAAQS. However, this petition includes contingency measures that may be put into place, if necessary, to correct NAAQS violations that may occur after re-designation of the area to attainment.

Attainment of the PM2.5 NAAQS

Table 2-1 displays the attaining 2013-2015 annual $PM_{2.5}$ design values for all federal reference method (FRM) monitoring sites in the Knoxville Fine Particulate Nonattainment Area. For this three-year period, the controlling annual design value is 10.0 $\mu g/m^3$, measured at Rule High School (ID #470931017) and Davanna Street, Air Lab (ID #470931013). This design value meets the 15 $\mu g/m^3$ standard.

1.0 INTRODUCTION

This petition is submitted to the United States Environmental Protection Agency (EPA) to request redesignation of the Knoxville, Tennessee fine particulate matter nonattainment area from nonattainment to attainment for the 1997 annual fine particulate ($PM_{2.5}$) National Ambient Air Quality Standard (NAAQS), pursuant to §107(d)(3) of the Clean Air Act (CAA). The Act specifies the following requirements for re-designation of nonattainment areas:

- The Administrator determines that the area has attained the national ambient air quality standard;
- The Administrator has fully approved the applicable implementation plan for the area under section 110(k);
- The Administrator determines that the improvement in air quality is due to permanent and enforceable reductions in emissions resulting from implementation of the applicable implementation plan and applicable Federal air pollutant control regulations and other permanent and enforceable reductions;
- The Administrator has fully approved a maintenance plan for the area as meeting the requirements of section 175A; and
- The State containing such area has met all requirements applicable to the area under section 110 and part D.

Tennessee is petitioning EPA for re-designation of the Knoxville annual $PM_{2.5}$ nonattainment area to attainment based on an attaining three-year design value for the period 2013-2015. This document demonstrates that the Knoxville $PM_{2.5}$ nonattainment area meets the above requirements and can petition the EPA for re-designation to attainment. Ambient air quality data indicates that the area is attaining the NAAQS, and attainment has been achieved using existing controls (see Section 2.0 for additional information). This petition does not preclude Tennessee from implementing additional controls in the Knoxville area in order to avoid future designations resulting from future revisions of the annual $PM_{2.5}$ NAAQS.

1.1 Knoxville Geologic Region - Ridge and Valley

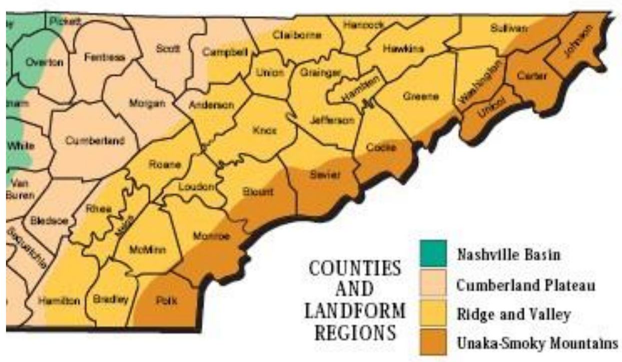
The city of Knoxville is located within the Ridge and Valley region of the State of Tennessee, which is located between the Cumberland Plateau to the west and the Blue Ridge Mountains to the east (Figure 1-1). The width of the region ranges from 30 to 70 miles, with an average width of 45 miles. The topography of the Ridge and Valley consists of long linear ridges and parallel lowland valleys that trend in a northeast to southwest direction. The ridges usually have high elevations of 1,100 to 1,500 feet[1] while the adjacent valley floors vary from 700 to 1,000 feet. The ridges and valleys generally have higher elevations in the northern part of the region, with slightly lower elevations to the south.

1 All elevations are relative to sea level.

1.2 Blue Ridge and Great Smoky Mountains

The Blue Ridge and Great Smoky Mountains[2] extend along the Tennessee-North Carolina border and is the easternmost physiographic province in Tennessee. This region consists of high peaks and heavily forested terrain, broken by deeply carved stream valleys. The Great Smoky Mountains includes the highest point in the State of Tennessee at Clingman's Dome (6,643 ft.) in Sevier County. In addition to Clingman's Dome, there are 13 other mountain peaks in the Blue Ridge with heights of over 6,000 feet and 33 peaks of more than 5,000 feet. A large percentage of those peaks are situated directly on the Tennessee/North Carolina border, with the greatest concentration found in Sevier County. Narrow lowland valleys and isolated coves, ranging from 1,000 to 2,000 feet in elevation, are also a part of the region's topography.

Figure 1-1: Knoxville Area Geologic Regions



1.3 Climate Synopsis for East Tennessee[3]

Tennessee's topography is highly varied and has a significant impact on the state's climate. The landscape varies generally from west to east, starting with the gently rolling lowlands in the west, and dominated by the Blue Ridge Mountains in the east. Average annual temperatures across the State range from about 55° F to 60° F, with mean winter temperatures of about 35° F and summer temperatures 75° to 80° F. These general patterns are affected by topography, and the mountain areas tend to have milder summers and colder, more blustery winters. In the Ridge and Valley region of east Tennessee, annual precipitation ranges from 40 inches in the north to over 50 inches in the south. The Blue Ridge region is the wettest part of the State, with annual totals of up to 80 inches in the higher elevations. In general, the greatest precipitation occurs in winter and early spring[4], with a secondary maximum of precipitation from midsummer thunderstorms.

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2 The Great Smoky Mountains are part of the Blue Ridge Mountains, which run from northern Georgia to Pennsylvania. "Great Smoky Mountains" typically refers to the portion of the Blue Ridge located in Blount, Cocke, and Sevier Counties in Tennessee, and within the adjacent North Carolina counties.

3 Adapted from: *Climatography of the United States*, No. 60, National Climatic Center

4 The higher rainfall totals in winter and early spring are primarily due to the more frequent passage of large-scale (frontal) storms.

1.4 Knoxville MSA Meteorology

The climate of the Knoxville Metropolitan Statistical Area (MSA) is strongly influenced by the surrounding mountains. July is usually the warmest month of the year, and the coldest weather typically occurs during January. Sudden temperature changes are infrequent, mainly due to the retarding effect of the mountains. The average high temperature for the year is 69.3 degrees. Daytime winds usually have a southwesterly component, while nighttime winds usually move from the northeast. The winds are relatively light, averaging 6.9 mph for the year.

Rainfall is favorably distributed during the year. Precipitation is greatest in the winter, with a secondary peak during the late spring and summer months. The period of lowest rainfall occurs during the fall. The surrounding mountains serve as a fixed incline plane, which lifts the warm, moist air flowing northward from the Gulf of Mexico and increases the frequency of afternoon thunderstorms. These thunderstorms reduce the number of extremely warm days in the valley and provide relief from extremely high temperatures.

2.0 AIR QUALITY

Fine particulate matter, or $PM_{2.5}$, refers to particles suspended in air having an aerodynamic diameter of 2.5 micrometers (μm) or less. These particles may be composed of various compounds and caused by many different sources, but are classified as a single air pollutant. Inhalation of $PM_{2.5}$ can negatively impact cardiovascular and respiratory health, especially in children and those with enhanced sensitivity caused by heart or lung ailments.

The $PM_{2.5}$ category encompasses solids, liquids, and solid particles coated by liquids. Primary $PM_{2.5}$ is emitted to the atmosphere directly, as opposed to secondary $PM_{2.5}$, which is formed in the atmosphere by the chemical reaction of precursor compounds, such as sulfur dioxide (SO_2), nitrogen oxides (NO_X), and organic gases. $PM_{2.5}$ constituents include sulfates, nitrates, primary organic compounds, secondary organic aerosols (SOA), elemental carbon, and crustal materials.

The largest anthropogenic sources of fine particulate matter and its precursors are fuel burning sources, such as coal-burning power plants, motor vehicles, and combustion operations, as well as some industrial processes. $PM_{2.5}$ concentrations in ambient air are dependent upon meteorological and geographical variables.

2.1 $PM_{2.5}$ National Ambient Air Quality Standards

On July 18, 1997, EPA promulgated an update to the 24-hour and annual NAAQS for $PM_{2.5}$ (*Federal Register* Vol. 62, No. 138, pp. 38652–38760). The updated 24-hour standard was 65 μg/m^3, and the annual standard was set to 15.0 μg/m^3. The 24-hour standard is met when the 98th percentile daily $PM_{2.5}$ monitored concentration (the value below which 98% of the values in a calendar year fall), as averaged over three consecutive years, is less than or equal to the 24-hour NAAQS. The annual standard is met when the annual mean of daily $PM_{2.5}$ monitored concentrations (average of quarterly-average values in a calendar year), as averaged over three consecutive years, is less than or equal to the annual NAAQS.

The 24-hour $PM_{2.5}$ NAAQS was subsequently revised to 35 $\mu g/m^3$ on October 17, 2006 (*Federal Register* Vol. 71, No. 200, pp. 61144–61233).

The U.S. EPA designated the Knoxville area as being in nonattainment with the 1997 standard on January 5, 2005 (*Federal Register* Vol. 70, No. 3, pp. 944–1019). The U.S. EPA designated the Knoxville area as being in nonattainment with the 2006 24-hour standard on November 13, 2009 (*Federal Register* Vol. 74, No. 218, pp. 58688–58781).

On September 4, 2012, EPA issued a Clean Data Determination declaring that the Knoxville Area had attained the 1997 annual average $PM_{2.5}$ NAAQS. As a result of this determination of attainment, the requirements for the Knoxville Area to submit attainment demonstrations and associated RACM, RFP plans, contingency measures, and any other planning SIPs related to attainment of the 1997 annual $PM_{2.5}$ NAAQS were suspended for so long as the Area continued to attain the standard, per 40 CFR 51.1004(c).

2.2 Knoxville, TN $PM_{2.5}$ Nonattainment Area

The Knoxville, TN $PM_{2.5}$ nonattainment area includes Knox County, Blount County, Anderson County, Loudon County, and part of Roane County, all of which are contained within the State of Tennessee. The part of Roane County included in the nonattainment area is the census block containing Tennessee Valley Authority's Kingston Fossil Plant (US Census 2000 block group 47-145-0307-2). Figures 2-1 and 2-2 depict the nonattainment area

Figure 2-1: Knoxville Fine Particulate Nonattainment Area Map

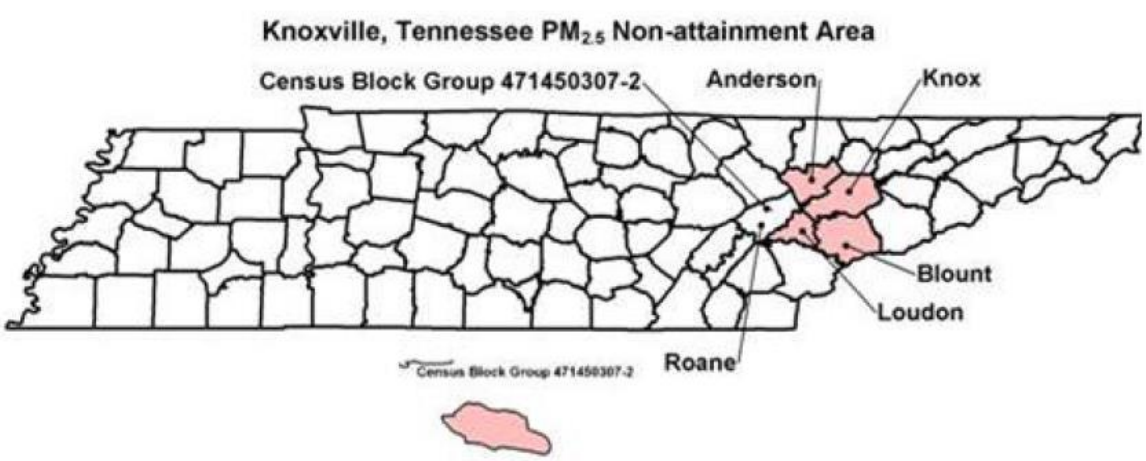


Figure 2-2: Map of Roane County Partial Nonattainment Area

2.3 $PM_{2.5}$ Federal Reference Method Monitors

Data collected by Federal Reference Method (FRM) Monitors are used to obtain daily concentrations of $PM_{2.5}$ in the ambient air. This data is used to determine attainment of the annual $PM_{2.5}$ NAAQS.

The annual mean $PM_{2.5}$ concentration (average of quarterly-average concentrations), based on quality-assured and certified data from an FRM monitor as averaged over three consecutive calendar years, is referred to as the monitor's annual $PM_{2.5}$ design value for that three-year period. Annual design values for each $PM_{2.5}$ FRM monitor are given below in Table 2-1. The design values in the table were obtained from $PM_{2.5}$ design value reports that are available at the U.S. EPA website https://aqs.epa.gov/api. Applicable portions of these reports are provided in Appendix A.

Table 2-1: Knoxville MSA Annual $PM_{2.5}$ Design Values by Year

$PM_{2.5}$ Federal Reference Method Monitor	Annual $PM_{2.5}$ Design Value (μg/m^3)									
	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015
Sequoyah Ave, Maryville (ID #470090011)	14.1	14.7	14.7	15.2	11.7	11	10.5	8.6*	8.9*	**8.6**
Bearden Middle School (ID #470930028)	15.2	15.7	16*	15.5	12	11.6	11.4	9.3*	9.4*	**9.2**
Davanna Street, Air Lab (ID #470931013)	11.8*	17.2*	17.2*	17.2*	12.7*	12.3	12.2	10.1*	9.9*	**10.0**
Rule High School (ID #470931017)	15.6	15.8	15.6*	15.5*	12.4	12	11.8*	10.2*	10.1*	**10.0**
Spring Hill Elementary School (ID #470931020)	15.2	15.3	14.8*	15.2	11.8	11.3	11.1	9.2*	9.3*	**9.1**
Loudon Pope site (ID #471050108)	15.3	15.7	15.5	16.1	12.4	11.7	11.3	9.1*	9.4*	**9.4**
Harriman High School (ID #471450004)	14.5	14.8	14.5	14.9	11.9	11.2	10.8	8.6*	8.9*	**8.7**

*Denotes incomplete or invalid data for monitor and year

3.0 PARTICULATE MATTER AND PRECURSER POLLUTANT EMISSIONS REDUCTIONS

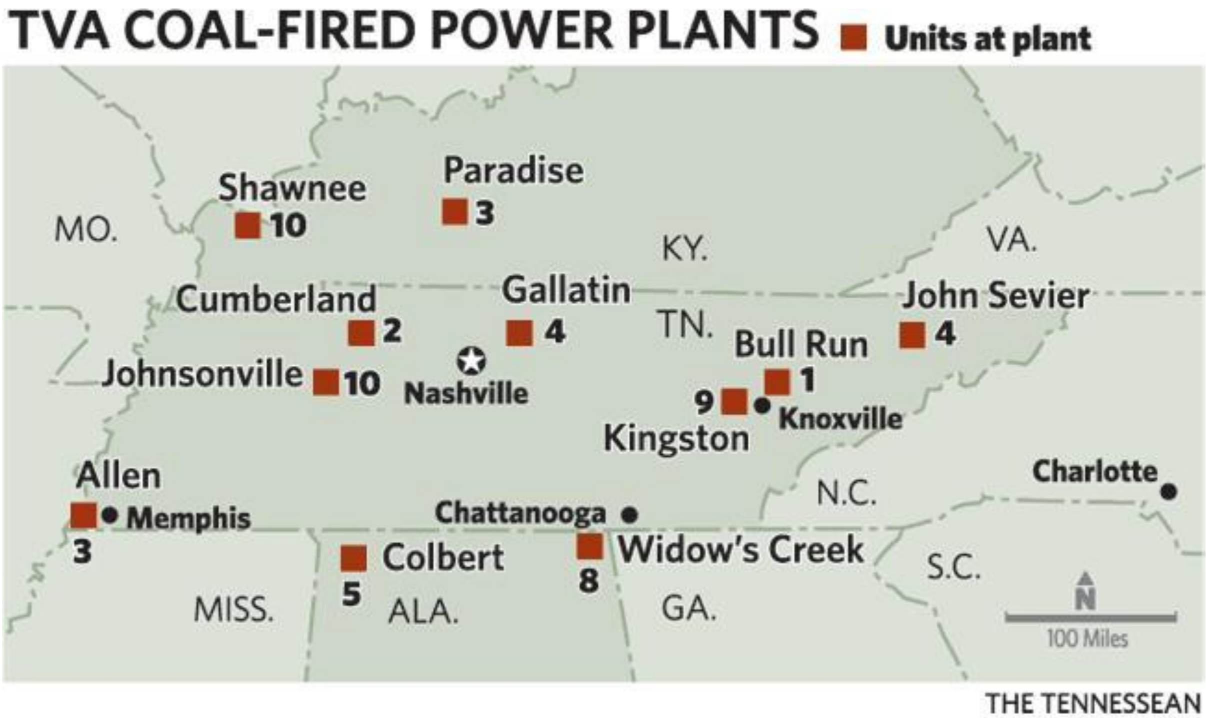
3.1 Permanent and Enforceable Reductions

Significant emissions reductions from coal-fired electricity generating units (EGUs) have contributed to the region's reduction in emissions and significant improvement in air quality. Tennessee is only claiming permanent and enforceable reductions for measures included in enforceable permits. Those measures not considered permanent, enforceable, and/or outside the nonattainment area are withheld from this section, but are included in Section 3.2 to provide further evidence of ambient air quality improvement.

3.1.1 Tennessee Valley Authority Consent Decree and Federal Facilities Compliance Agreement

On April 14, 2011, the Tennessee Valley Authority (TVA) entered into a consent decree with Tennessee, Alabama, Kentucky, and North Carolina to resolve allegations of violations of New Source Review and other conditions at TVA's coal-fired power plants. The Consent Decree is included as Appendix B. TVA entered into a Federal Facilities Compliance Agreement (FFCA) with EPA on the same date. The consent decree affects all facilities in the TVA system, including two fossil plants located in the nonattainment area (Bull Run and Kingston), and three fossil plants located outside of the nonattainment area (John Sevier in Tennessee, Widows Creek and Colbert in Alabama), but which are likely to affect the area based on proximity and/or prevailing wind direction (Figure 3-1). The Consent Decree measures are associated with substantial and sustainable positive air quality benefits, based on: 1) emission reductions occurring between 2011 and 2013; 2) enforceable requirements to maintain emission reductions that occurred prior to 2011; and 3) future reductions that will occur as a result of the Consent Decree and other measures. The Consent Decree requirements most responsible for achieving attainment of the standard have been incorporated into the Title V permits for TVA Bull Run and TVA Kingston Fossil Plants. The specific limits and permit conditions are submitted for incorporation into the state implementation plan. These specified limits and conditions are included in Appendix L.

Figure 3-1: TVA Fossil Plants



The consent decree includes the following requirements:

1. System-wide annual tonnage limitations for SO_2.
2. Requirements to continuously operate existing PM controls and PM CEMS at Bull Run and Kingston.
3. Requirements to repower or retire units at John Sevier and Widows Creek.
4. Mandatory maximum PM emission rate of 0.030 lb/MMBTU at Kingston and Bull Run as of the consent decree obligation date.

<u>System-Wide Annual Tonnage Limitations for SO_2</u>: Paragraph 82 of the Consent Decree specifies that NO_X emissions from all units in the TVA System, including any new combined cycle and simple cycle combustion turbine units[5], shall not emit SO_2 in excess of system-wide annual tonnage limitations (Table 3-1). Paragraphs 90 and 91 of the Consent Decree prohibit TVA from the use of SO_2 allowances to comply with any requirement of the Consent Decree and require TVA to surrender SO_2 allowances allocated to the TVA System for 2011 and subsequent calendar years.

5 Paragraph 117 of the Consent Decree allows TVA to utilize SO_2 reductions from the retirement of coal-fired capacity to construct new combined cycle and simple cycle combustion turbines to make up for the loss of generating capacity.

Table 3-1: System-Wide SO_2 Limits, TVA Consent Decree

Calendar Year	System-Wide SO_2 Limitation (tons)
2011	285,000
2012	285,000
2013	235,518
2014	228,107
2015	220,631
2016	175,626
2017	164,257
2018	121,699
2019, and each year thereafter	110,000

Existing Controls at TVA Bull Run and TVA Kingston: Paragraph 85 of the Consent Decree states that no later than the dates set forth in Table 3-2, and continuing thereafter, TVA shall install and commence continuous operation of the specified pollution control technology for SO_2.

Table 3-2: SO_2 Control Requirements for Bull Run and Kingston

Plant	Unit	Control Requirement	Date
Bull Run	Unit 1	Wet FGD	April 14, 2011
Kingston	Unit 1	Wet FGD	April 14, 2011
Kingston	Unit 2	Wet FGD	April 14, 2011
Kingston	Unit 3	Wet FGD	April 14, 2011
Kingston	Unit 4	Wet FGD	April 14, 2011
Kingston	Unit 5	Wet FGD	April 14, 2011
Kingston	Unit 6	Wet FGD	April 14, 2011
Kingston	Unit 7	Wet FGD	April 14, 2011
Kingston	Unit 8	Wet FGD	April 14, 2011
Kingston	Unit 9	Wet FGD	April 14, 2011

Figures 3-2 and 3-3 display CAMD data for SO_2 and NO_X emissions from TVA Kingston and TVA Bull Run from 2004 through 2014. Between 2008 and 2014, the two plants' combined emissions of SO_2 have decreased 97.1% and combined emissions of NO_X have decreased 81.9%, while gross electrical load has only dropped 39.8%. In terms of pounds emitted per megawatt-hour, this represents improvements of 95.2% in SO_2 control efficiency and 70.0% in NO_X control efficiency from 2008 to 2014.

Figure 3-2: Knoxville Area Fossil Plant Sulfur Dioxide Emissions 2004-2014

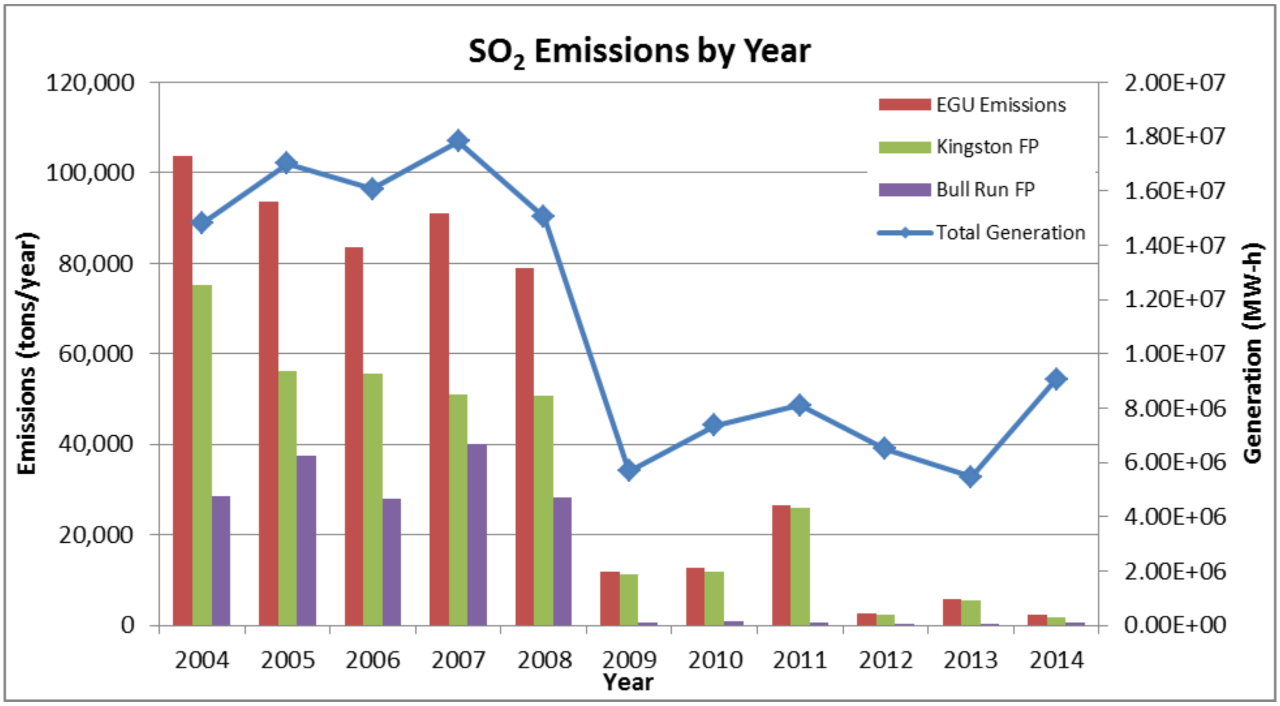
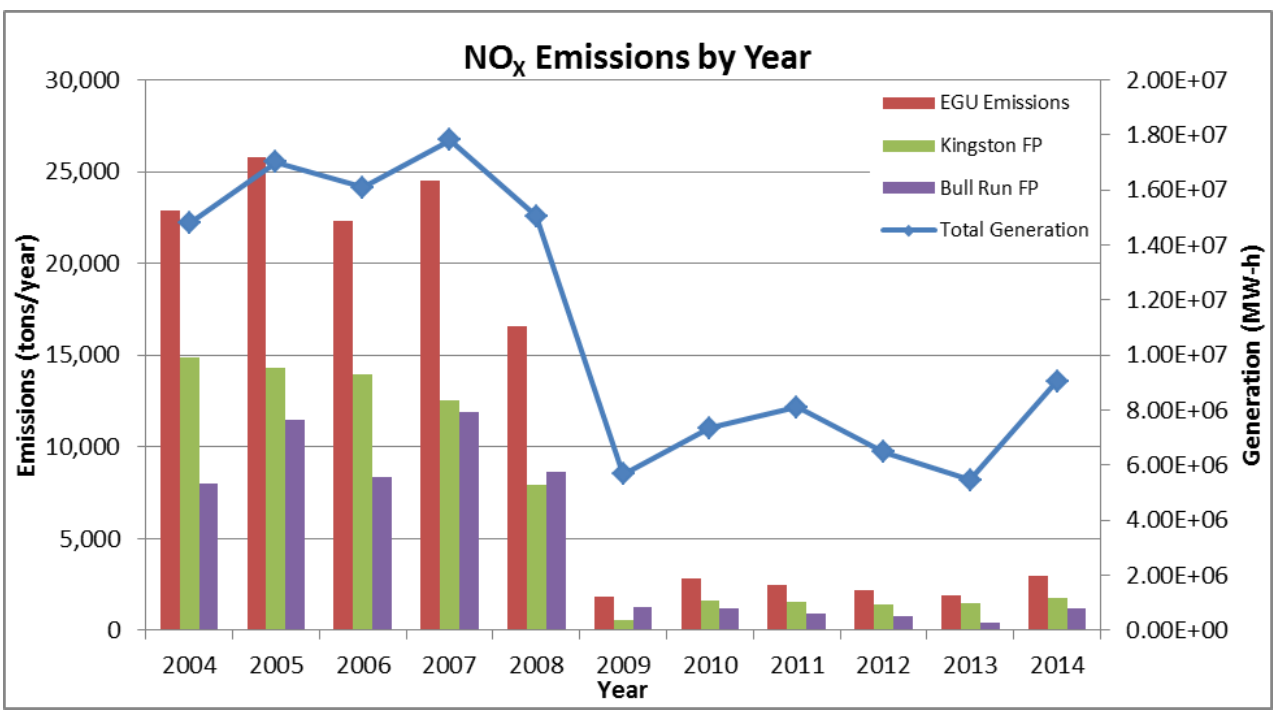


Figure 3-3: Knoxville Area Fossil Plant Nitrogen Oxides Emissions 2004-2014



TVA John Sevier and TVA Widows Creek: Paragraph 85 of the Consent Decree also states that no later than the dates set forth in Table 3-4, TVA shall repower, remove from service, or retire the units at John Sevier and Widows Creek identified below:

Table 3-3: SO_2 Control Requirements for John Sevier and Widows Creek

Plant	Unit	Control Requirement	Date
John Sevier	2 Units	Retire	December 31, 2012
John Sevier	2 Other Units	Remove from Service	December 31, 2012
		FGD, Repower to Renewable Biomass, or Retire	December 31, 2015
Widows Creek	Units 1-6	Retire	2 Units by July 31, 2013
			2 additional Units by July 31, 2014
			2 additional Units by July 31, 2015
Widows Creek	Unit 7	Wet FGD	Consent Decree Obligation Date
Widows Creek	Unit 8	Wet FGD	Consent Decree Obligation Date

TVA John Sevier Fossil Plant and Combined Cycle Plant are approximately 65 miles northeast of Knoxville. Table 3-4 shows annual SO_2 emissions from the John Sevier Fossil Plant and John Sevier Combined Cycle Plant between 2008 and 2014. Annual SO_2 emissions declined by almost 100% between 2008 and 2014 as coal-fired units 1 through 4 were retired and replaced with the natural gas combined cycle plant. EPA's CAMD database indicates the following information for each unit:

- Coal-fired Unit 1 operated 8 months in 2011, 6 months in 2012; did not operate after August 2012.
- Coal-fired Unit 2 operated 10 months in 2011, 7 months in 2012; did not operate after August 2012.
- Coal-fired Unit 3 operated 8 months in 2011, 5 months in 2012; did not operate after August 2012.
- Coal-fired Unit 4 operated 10 months in 2011, 2 months in 2012; did not operate after April 2012.
- Combined cycle Units 1, 2, and 3 began operation in April 2012.

Table 3-4: Acid Rain Program Annual SO_2 Emissions for John Sevier Fossil Plant and John Sevier Combined Cycle Plant
2008-2014

Year	Heat Input (MMBtu)	Annual SO_2 Emissions (tons)	Annual SO_2 Emission Rate (lb/MMBtu)
2008	48,128,525	27,745	1.15
2009	36,442,513	20,316	1.11
2010	39,406,198	22,540	1.14
2011	24,994,392	15,212	1.22
2012	31,300,865	4,387	0.28
2013	15,753,682	5	0.00
2014	24,049,557	8	0.00

TVA Widows Creek Fossil Plant is approximately 150 miles southwest of Knoxville, and prevailing winds are from southwest to northeast. Table 3-5 shows annual SO_2 emissions from the Widows Creek Fossil Plant between 2008 and 2014. Annual SO_2 emissions declined by about 49% between 2008 and 2014, as units 1 through 6 were taken offline. EPA's CAMD database indicates the following information for each unit:

- Unit 1 did not operate after December 2010.
- Unit 2 did not operate after July 2010.
- Unit 3 did not operate after July 2010.
- Unit 4 did not operate after December 2010.
- Unit 5 did not operate after July 2010.
- Unit 6 did not operate after August 2011.

Table 3-5: Acid Rain Program Annual SO_2 Emissions for Widows Creek Fossil Plant 2008-2014

Year	Heat Input (MMBtu)	Annual SO_2 Emissions (tons)	Annual SO_2 Emission Rate (lb/MMBtu)
2008	100,024,301	27,903	0.56
2009	51,450,637	12,861	0.50
2010	62,171,954	10,982	0.35
2011	51,073,034	5,770	0.23
2012	48,710,049	6,321	0.26
2013	43,183,811	5,590	0.26
2014	43,672,988	6,271	0.29

3.1.2 PM Emission Rate Set by Consent Decree

On the Consent Decree obligation date of April 14, 2011, the mandatory maximum PM emission rate at TVA Kingston and TVA Bull Run was lowered to 0.030 lb/MMBtu. This limit has been added to the Title V permits for each facility, and has provided significant permanent reductions to emissions of primary $PM_{2.5}$ from these two large sources.

3.1.3 Onroad Mobile-Source Emissions Reduction Measures

Federal standards for National Low Emission Vehicles (NLEV) began in 1999, and implemented through 2001 for new light duty cars and trucks. EPA has since implemented further reductions from onroad mobile sources; the Federal Tier 2 vehicle emission standards. For example, Federal Tier 2 vehicle emission standards require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and Sport Utility Vehicles (SUVs), to meet an average standard of 0.07 grams of oxides of nitrogen (NO_x)

per mile in 2007[6]. The Tier 2 standards also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (the larger pickup trucks and SUVs), which are not covered by the Tier 1 regulations. For these vehicles, the standards were phased in beginning in 2008, with full compliance in 2009. The new standards require vehicles to be 77% to 95% cleaner than those manufactured to meet Tier 1 standards. The Tier 2 rule also reduced the sulfur content of gasoline to 30 parts-per-million (ppm) starting in January of 2006. Most gasoline sold in Tennessee prior to January 2006 had a sulfur content of up to 300 ppm. Sulfur occurs naturally in gasoline, but interferes with the operation of catalytic converters on vehicles resulting in higher NO_x emissions. The combination of lower-sulfur gasoline and the Tier 2 engine emissions standards are necessary to achieve the Tier 2 vehicle emission standards.

The EPA has promulgated a Tier 3 rule designed to reduce air pollution from new passenger cars and trucks. Beginning in 2017, Tier 3 emissions standards will lower the sulfur content of gasoline, and lower the emissions standards from light duty passenger cars and trucks[7]. Benefits from Tier 3 vehicles will help the area to continue to assure maintenance of the air quality standards.

New EPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles began to take effect in 2004. A second phase of standards and testing procedures, beginning in 2007, will reduce particulate matter from heavy-duty highway engines, and will also reduce highway diesel fuel sulfur content to 15 ppm, allowing for additional emission control devices. The total program, when fully implemented, is expected to achieve a 90% reduction in particulate matter (PM) emissions and a 95% reduction in NO_x emissions for these new engines using ultra low sulfur diesel, compared to existing engines using higher sulfur content diesel[8].

As older, more polluting vehicles leave the fleet, and are replaced by newer, lower emitting cars and trucks, emissions from vehicles subject to EPA's Federal Motor Vehicle Control Programs are expected to decrease significantly. EPA's Tier 3 motor vehicle emissions control program, not yet in effect, is expected to contribute to even further emissions reductions from the onroad mobile source sector.

Effective in 2005, the Tennessee Air Pollution Control Board promulgated a statewide motor vehicle anti-tampering rule. This rule, defined in Chapter 1200-3-36, Motor Vehicle Tampering, was promulgated to reduce the air pollution caused by tampering with a motor vehicle's emissions control system. The area of applicability for this rule is statewide. Chapter 1200-3-36 defines tampering as modifying, removing or rendering inoperative any air pollution emission control device, which results in an increase in emissions beyond established federal motor vehicle standards. Additionally, the rule identifies what is specifically prohibited, for example, removing a catalytic converter.

Tennessee has promulgated rules for Stage I Gasoline Vapor Recovery for several counties throughout Tennessee, including Anderson, Blount, Jefferson, Knox, Loudon, and Sevier Counties in the greater

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6 Environmental Protection Agency, *Federal Register***,** Vol. 65, No. 28, February 10, 2000.
7 Environmental Protection Agency, *Control of Air Pollution From Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards; Final Rule*. *Federal Register*, Vol. 79, No. 81, April 28, 2014.
8 Environmental Protection Agency, *Federal Register*, Vol. 66, No. 12, January 18, 2001.

Knoxville area. Gasoline dispensing stations in these counties that were existing sources on December 29, 2004, were required to comply with this rule by May 1, 2006.

3.2 Other Reductions

The reductions outlined in this section are not suitable for inclusion in Section 3.1 as they are not reliably permanent or enforceable; however, they still contribute to the improvement of air quality and attainment of the 1997 annual $PM_{2.5}$ NAAQS in the Knoxville area.

3.2.1 $PM_{2.5}$ and Ozone Transport Rules

In October 1998, the U.S. EPA made a finding of significant contribution to ozone formation due to NO_X emissions from certain states and published the "NO_X Budget Trading Program for State Implementation Plans" (the NO_X SIP Call, Title 40 *Code of Federal Regulations* Part 96, Subparts A–I), which set ozone-season NO_X emission budgets for the purpose of reducing regional transport of ozone. This rule called for NO_X emission budgets to be established for twenty-two eastern states (and the District of Columbia), including Tennessee. Each subject state was required to develop rules requiring the control of NO_X emissions from utility and industrial boilers that would allow the state to meet its budget by 2004. A NO_X emission trading program was also established, allowing sources to buy credits to meet the applicable budget rather than implement expensive NO_X emission controls.

On May 12, 2005, EPA promulgated the "Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone [Clean Air Interstate Rule (CAIR)]" (*Federal Register* Vol. 70, No. 91, pp. 25162–25405). This rule established a requirement for states to regulate NO_X and SO_2 emissions from fossil-fuel burning electric generation units (EGUs) with capacities exceeding 25 megawatts. Annual limits on state-wide emissions of NO_X and SO_2 were to be set in phases beginning in 2009 and continuing through 2015.

On July 11, 2008, the U.S. Court of Appeals for the District of Columbia Circuit vacated CAIR and remanded it to the U.S. EPA. A rehearing of the Court's decision was requested and granted. On December 23, 2008, the Court remanded CAIR to the U.S. EPA without vacatur (i.e., the rule was still in place). EPA was directed to correct the deficiencies in CAIR that were identified in the Court's decision.

To replace CAIR, the U.S. EPA promulgated the "Transport Rule" [Cross-State Air Pollution Rule (CSAPR)] on August 8, 2011 (*Federal Register* Vol. 76, No. 152, pp. 48208–48483). This rule was to impose restrictions on emissions of NO_X and SO_2 from states identified as having significant impacts on ozone and/or $PM_{2.5}$ NAAQS attainment or as interfering with maintenance of these standards in downwind states. The requirements of CSAPR were to become effective in 2012 and 2014. The U.S. Court of Appeals for the District of Columbia Circuit issued respective rulings on December 30, 2011, and August 21, 2012, at first to stay CSAPR, pending judicial review, and then to vacate it.

Finally, on October 23, 2014, the DC Circuit Court of Appeals granted a petition to lift the stay imposed on CSAPR in response to the United States Supreme Court decision in *EPA v. EME Homer City Generation*, L.P., 134 S. Ct 1584 (2014). Implementation of CSAPR began January 1, 2015 (79 Fed. Reg. 71663), at which point CSAPR superseded the Clean Air Interstate Rule. However, due to ongoing litigation involving CSAPR, its status as permanent and enforceable is not secure. It is included as simply an additional measure of emissions reductions.

Regardless of the timing of transition from CAIR to CSAPR, emissions of NO_X and SO_2 affecting the Knoxville nonattainment area have declined significantly and are expected to continue to decrease due, in large part, to the continuation of the Federal Facilities Compliance Agreement between the U.S. EPA and TVA, all applicable requirements of which have been adopted into the Title V permits for the TVA fossil plants located in the Knoxville area.

3.2.2 Mobile Source Emissions Reduction Programs

The State of Tennessee and Knox County maintain an air quality forecasting program for the Knoxville Area. When it is anticipated that fine particulate pollution may exceed healthy levels, a "Spare the Air" alert is issued[9]. Once the air quality forecast is issued, the media is able to release these alerts in a timely fashion, and air quality alert days are announced to the public through television and radio. Citizens can also receive e-mail notification of air quality alerts via EnviroFlash and AirNOW. Many businesses subscribe to the alerts and conduct their own activities to help reduce emissions that are precursors to fine particulates.

Overhead Dynamic Message Signs located on Knoxville interstates have been used to notify drivers of program recommendations on air quality alert days. Efforts are underway to continue the use of this medium in conjunction with TDOT's 511 information program. The Knoxville region has a nationally recognized Smart Trips program in effect in the Knoxville area, including Anderson, Blount and Knox counties.

3.2.3 Retirement of TVA Widows Creek Unit 8, TVA Colbert Units 1-5

The TVA Board of Directors adopted a resolution at the November 2013 Board meeting to address one unit of TVA's Widows Creek Fossil Plant (Unit 8) and all five units at TVA's Colbert Fossil Plant in Alabama. The resolution approved retirement of Colbert Fossil Plant Units 1-5 and Widows Creek Fossil Plant Unit 8, with such retirements to be effective on a date or dates to be determined by TVA's Chief Executive Officer based on fiscal and operational needs as well as TVA's obligations under Mercury and Air Toxics Standards (MATS) and the Consent Decree. NO_X emissions from Widows Creek Unit 8 are shown in Table 3-6. Widows Creek Unit 8 was shut down permanently in October 2014. The last operating EGU at Widows Creek, Unit 7, was retired a year later in October 2015.

9 https://cfpub.epa.gov/airnow/index.cfm?action=airnow.main (Last accessed 3/23/16).

Table 3-6: Acid Rain Program Annual SO_2 Emissions for Widows Creek Unit 8 2008-2014

Year	Heat Input (MMBtu)	Annual SO_2 Emissions (tons)	Annual SO_2 Emission Rate (lb/MMBtu)
2008	28,082,926	2,816	0.20
2009	14,983,437	1,938	0.26
2010	32,604,014	4,647	0.29
2011	26,950,729	2,876	0.21
2012	20,937,619	2,503	0.24
2013	22,358,494	2,741	0.25
2014	18,207,655	2,650	0.29

SO_2 emissions from Colbert Fossil Plant are shown in Table 3-7. Average annual SO_2 emissions between 2008 and 2014 were 19,771 tons. Colbert Fossil Plant is about 250 miles west-southwest of Knoxville, and the impact of these reductions will be comparatively lower than equivalent reductions at other plants. However, the reductions are likely to have a positive impact on future air quality within the Knoxville region, considering the magnitude of the emission changes. The coal boilers at Colbert Fossil Plant were retired permanently on March 23, 2016.

Table 3-7: Acid Rain Program Annual SO_2 Emissions for Colbert Fossil Plant 2008-2014

Year	Heat Input (MMBtu)	Annual SO_2 Emissions (tons)	Annual SO_2 Emission Rate (lb/MMBtu)
2008	77,778,724	32,574	0.84
2009	31,515,720	16,520	1.05
2010	63,711,570	23,175	0.73
2011	50,502,949	18,483	0.73
2012	35,980,144	12,856	0.71
2013	35,551,439	13,161	0.74
2014	37,816,019	21,627	1.14

4.0 MAINTENANCE PLAN & EMISSIONS INVENTORY

The maintenance plan must assure the continued attainment of the 1997 annual $PM_{2.5}$ NAAQS for a period of at least ten years after the U.S. EPA has formally redesignated the nonattainment area to attainment as a "maintenance area". The plan must demonstrate that future attainment of the standard is expected to continue, including verification of continued attainment of the standard and contingency measures to be implemented if the standard is either exceeded or determined to be at risk of being exceeded. EPA previously approved the 1997 annual $PM_{2.5}$ 2002 base year emissions inventory portion of the SIP revision submitted by the State of Tennessee on April 4, 2008. The emissions inventory was part of Tennessee's April 4, 2008, attainment demonstration SIP revision that was submitted to meet the section 172(c) Clean Air Act (CAA or Act) requirements related to the Knoxville nonattainment area for the 1997 annual $PM_{2.5}$ NAAQS.

4.1 Maintenance Demonstration

This maintenance demonstration of the 1997 annual $PM_{2.5}$ NAAQS is based on the assurance that future annual emissions of $PM_{2.5}$, its significant precursors SO_2 and NO_X, and its precursors including VOCs and ammonia, from all sources within the Knoxville nonattainment area, will not exceed the respective emission levels of the attainment year.

4.1.1 Attainment Year Emissions Inventory

Ambient air monitoring data from monitors in the Knoxville nonattainment area indicated attainment with the 1997 NAAQS for the three year period from 2013 through 2015. The Division has chosen to use 2014 as the attainment, or base, year for the Knoxville nonattainment area. Emissions of $PM_{2.5}$ and its precursors and significant precursors from point, area, onroad mobile, and nonroad mobile sources occurring in the Knoxville nonattainment area during 2014 are consistent with attainment of both the 1997 annual standard.

The “point sources” inventory (see Appendix C) includes emissions from certain industrial, commercial, and institutional stationary sources. These sources are required to submit actual emissions data to state or local air permitting authorities for inclusion in the National Emissions Inventory (NEI), which is completed triennially. The basis for each facility’s reported emissions is either direct measurement, material balance calculations, estimation using emission factors, or other methods of direct estimation. The 2014 base year point source emissions for the Knoxville area were obtained from the 2014 NEI. Point source emissions for Knox County were provided by the Knox County Department of Air Quality Management. Direct $PM_{2.5}$ emissions (PM2.5-PRI) as presented in this inventory represent the combined emissions of condensable $PM_{2.5}$ (PM2.5-CON) and filterable $PM_{2.5}$ (PM2.5-FIL) as they appear in the 2014 NEI.

The area source inventory (see Appendices D and E) is comprised of emissions from residential stationary sources and any industrial, commercial, or institutional stationary sources which are not required to report their emissions as point sources. Area source inventories include the total estimated emissions for entire source categories in a given geographical area with emissions from point sources subtracted out to avoid double counting. The area source emission inventory was developed using EPA Nonpoint files located on EPA’s CHIEF Emission Inventory website for the 2014 NEI, and for those area sources that have point source contribution, available point source activity data was subtracted to eliminate double counting. Area source emission estimates were developed for 135 source classification codes (SCC). Area source emissions for Knox County were provided by the Knox County Department of Air Quality Management.

Mobile Sources

Onroad mobile sources as an emissions source category is comprised of a large number of individual sources. Onroad mobile sources include all vehicles certified for onroad use. These include, for example, cars, motorcycles, pickup trucks, buses, delivery trucks and long-haul trucks (18 wheelers). As a group, onroad vehicles emit significant amounts of certain air pollutants. Emissions from onroad sources are estimated through the use of locally gathered information on the vehicle population and the miles driven in each county, as well as a number of other inputs, combined with EPA's Motor Vehicle Emissions Simulator (MOVES) model. Details on the development of the onroad emissions are contained in Appendix K.

The emission inventory for nonroad mobile sources was obtained from EPA's Nonroad files located on EPA's EIS Gateway for the 2011 NEI and using the MOVES2014a Motor Vehicle Emission Simulator.

The emission estimates for the 10 nonroad mobile source categories were developed using EPA's MOVES2014a, which includes the latest nonroad estimates for growth based on expected future economic conditions and other factors as well as any national controls that apply to these sources in future years. The 2014 fuel inputs were obtained from Tennessee Department of Transportation (TDOT). The 2014 default base year information and corresponding year national county-level database was used to develop the most representative MOVES model inventory, and used to generate annual emission estimates for the required pollutants. Nonroad inventories are included in Appendix F for Knox County and Appendix G for the surrounding counties.

Estimates of aircraft, locomotive, and commercial marine (ALM) emissions are not produced by the MOVES2014a model. ALM emissions for 2014 were primarily based on EPA's 2011 National Emissions Inventory (NEI), as described in EPA's 2011 NEI documentation. ALM inventories can be found in Appendix H for Knox County and Appendix I for the surrounding counties.

4.1.2 Projected Emissions Inventory

Demonstration of future maintenance of the 1997 $PM_{2.5}$ NAAQS is required for a period of ten years following the presumed date of redesignation, which is planned to extend no later than 2028. This demonstration includes projected emissions inventories for $PM_{2.5}$, SO_2, NO_X, ammonia, and VOC for 2017, 2020, 2023, 2026, and 2028. This demonstration is made to show that these projected inventories from all sources combined will not exceed the respective emissions for the attainment year 2014.

Projected inventories for point sources were calculated using growth factors derived from the 2015 Annual Energy Outlook (AEO2015) developed by the U.S. Energy Information Administration, which is included as Appendix J. Growth factors were developed for point sources based on North American Industry Classification System (NAICS) codes and/or Source Classification Codes (SCC).

Source specific growth factors were utilized when possible. Table 4-1 displays source-specific growth factors and their derivations.

Table 4-1: Site-Specific Growth Factors for Points Sources in the Knoxville Area

Point Source	Growth Factors					Justification
	2017	2020	2023	2026	2028	
Cemex Construction Materials Atlantic, LLC	1.0	1.0	1.0	1.0	1.0	No planned expansion or reduction
Leisure Pools and Spas Manufacturing NA, Inc.	2.74	5.38	5.38	5.38	5.38	Planned expansion of 40% per year for the next 5 years (2014 was first year of production at facility)
Gerdau Ameristeel	1.25	1.25	1.25	1.25	1.25	Planned expansion from 600,000 TPY steel production to 750,000 TPY steel production
Schick Manufacturing Inc.	1.0	1.0	1.0	1.0	1.0	No planned expansion.
Republic Plastics, L.P. - K1 Plant	1.5	1.5	1.5	1.5	1.5	New permit issued Feb 2016 expanded facility capacity by 50%
Republic Plastics, L.P. - K2 Plant	1.5	1.5	1.5	1.5	1.5	New permit issued Feb 2016 expanded facility capacity by 50%
Tate and Lyle	0.05*	0.05*	0.05*	0.05*	0.05*	Repowered coal boilers to natural gas

* Sulfur dioxide emissions from boilers only. Growth factors for other pollutants and emissions units were derived from AEO2015.

Future-year nonpoint emissions were projected for years 2017, 2020, 2023, and 2026, and 2028 using 2014 emissions and growth factors obtained from Annual Energy Outlook 2015 energy forecasts for consumption and production, and TranSystems Category Specific Growth Factors projected from 2014 to 2028.

Future-year nonroad mobile emissions were projected for 2017, 2020, 2023, 2026 and 2028 using 2011 emissions and national growth factors. Growth factors were multiplied by the 2014 emission values to calculate emissions for future years. Overall, projected emissions from nonroad sources appear to be decreasing between 2014 and 2028. Aircraft NO_x and VOC emissions are predicted to increase.

4.1.3 Onroad Emissions Inventory Development

The emissions inventory for onroad sources was developed in conjunction with the Knoxville Regional Transportation Planning Organization (TPO), the Knox County Department of Air Quality Management and TDOT. Development of the onroad emission inventory followed EPA's Technical Guidance on the use of MOVES for SIP inventory development[10]. Onroad emissions are developed through the use of locally gathered data applied to EPA's Motor Vehicle Emissions Simulator (MOVES) model. Some of the locally developed data includes vehicles miles travelled (VMT) and vehicle population. Table 4-2 and Table 4-3 summarize the VMT and vehicle population in the nonattainment area. Note that these estimates include only the partial area of Roane County that has been designated nonattainment.

10 *MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emissions Inventories for State Implementation Plans and Transportation Conformity*. US EPA. EPA-420-B-15-093, November 2015.

Table 4-2: Annual Vehicle Miles Traveled by County for 2014 and 2028

Source Type	Source Type ID	Anderson 2014	Anderson 2028	Blount 2014	Blount 2028	Knox 2014	Knox 2028	Loudon 2014	Loudon 2028	Roane (partial) 2014	Roane (partial) 2028
		----- Annual Vehicle Miles Traveled -----									
Motorcycle	11	6,724,016	8,113,111	7,207,348	9,601,319	29,532,587	36,096,853	5,877,211	7,881,414	327,004	427,281
Passenger Car	21	378,365,138	451,869,442	461,766,418	615,442,106	2,327,888,547	2,830,625,802	331,259,897	444,539,269	19,235,918	25,073,804
Passenger Truck	31	322,229,134	384,832,020	508,514,839	677,741,471	2,077,305,052	2,525,935,045	363,458,299	487,750,620	20,285,814	26,402,677
Light Commercial Truck	32	53,367,205	73,018,656	86,707,882	114,891,738	417,077,955	537,566,735	53,132,333	70,587,346	3,153,678	4,285,511
Intercity Bus	41	41,112	42,364	15,589	16,758	153,419	201,591	89,154	97,217	-	-
Transit Bus	42	-	-	-	-	2,525,470	3,204,572	-	-	-	-
School Bus	43	614,194	787,621	401,104	520,200	1,625,639	2,066,357	843,553	1,161,913	60,847	79,506
Refuse Truck	51	658,380	838,751	445,539	571,006	3,071,204	3,898,663	1,195,062	1,603,736	-	-
Single Unit Short-haul Truck	52	14,734,259	18,659,814	17,964,462	23,154,199	98,180,859	124,821,725	15,856,789	21,408,364	1,088,938	1,461,040
Single Unit Long-haul Truck	53	701,926	885,710	591,121	760,161	3,674,307	4,676,822	1,086,311	1,474,768	165,164	187,509
Motor Home	54	470,246	596,105	448,847	578,241	2,653,130	3,372,958	661,089	891,652	57,611	65,405
Combination Short-haul Truck	61	14,618,232	18,981,308	9,070,238	12,388,393	97,298,347	127,536,566	20,165,661	28,340,692	1,545,387	1,844,720
Combination Long-haul Truck	62	50,265,429	65,355,622	30,146,848	41,161,219	330,133,046	432,736,562	70,654,922	99,360,669	4,815,394	6,466,622
Total:		842,789,271	1,023,980,525	1,123,280,233	1,496,826,812	5,391,119,561	6,632,740,251	864,280,281	1,165,097,661	50,735,755	66,294,075

Table 4-3: Vehicle Population in the Nonattainment Area

Vehicle Type	MOVES sourceType ID	Anderson	Blount	Knox	Loudon	Roane (partial)	Anderson	Blount	Knox	Loudon	Roane (partial)
		2014					2028				
Motorcycle	11	2,538	5,024	8,817	1,784	21	2,754	6,099	10,730	2,289	24
Passenger Car	21	38,956	51,652	171,062	21,973	268	42,267	62,706	208,182	28,191	310
Passenger Truck	31	32,610	54,328	140,750	22,856	271	35,382	65,954	171,293	29,324	313
Light Commercial Truck	32	4,489	7,862	24,722	2,869	34	5,580	9,489	31,891	3,644	41
Intercity Bus	41	1	1	6	1	-	1	1	8	1	-
Transit Bus	42	-	-	153	-	-	-	-	197	-	-
School Bus	43	90	155	383	57	1	112	187	494	72	1
Refuse Truck	51	32	30	184	42	0	40	36	237	53	-
Single Unit Short-haul Truck	52	1,183	2,200	7,683	1,061	11	1,470	2,655	9,911	1,347	13
Single Unit Long-haul Truck	53	42	49	271	47	0	52	59	350	60	1
Motor Home	54	242	320	1,683	246	3	301	386	2,171	312	3
Combination Short-haul Truck	61	483	300	3,217	667	7	600	362	4,150	847	8
Combination Long-haul Truck	62	533	320	3,503	750	7	663	386	4,519	953	9
Total:		81,199	122,241	362,434	52,353	624	89,222	148,320	444,133	67,093	723

EPA's MOVES model, version 2014a, was used to estimate emissions from onroad mobile sources in the nonattainment area. The version of the MOVES database used is the October 28, 2015 version with county specific data substituted, as available. Onroad emissions of ammonia, NO_X, $PM_{2.5}$, SO_2 and VOC are contained in Tables 4-4 through 4-8.

Table 4-4: Onroad Emissions of Ammonia by County

	Ammonia (NH3)					
	2014	2017	2020	2023	2026	2028
	----- tons/year -----					
Anderson	31.38	30.23	29.08	27.93	26.78	26.02
Blount	44.33	43.05	41.78	40.51	39.23	38.38
Knox	195.38	189.60	183.82	178.04	172.26	168.41
Loudon	32.29	31.75	31.21	30.67	30.12	29.76
Roane	2.03	1.96	1.89	1.83	1.76	1.72
Grand Total	305.40	296.59	287.78	278.97	270.16	264.29
Note: Emissions for 2017, 2020, 2023 and 2026 were interpolated between 2014 and 2028.						

Table 4-5: Onroad Emissions of Oxides of Nitrogen by County

	Oxides of Nitrogen (NOx)					
	2014	2017	2020	2023	2026	2028
	----- tons/year -----					
Anderson	1,993.39	1,734.02	1,474.65	1,215.28	955.91	782.99
Blount	1,894.20	1,589.20	1,284.20	979.20	674.20	470.87
Knox	9,517.67	8,008.79	6,499.90	4,991.02	3,482.13	2,476.21
Loudon	2,081.20	1,807.45	1,533.69	1,259.93	986.17	803.67
Roane	111.26	92.59	73.92	55.25	36.58	24.14
Grand Total	15,597.73	13,232.05	10,866.37	8,500.68	6,135.00	4,557.88
Note: Emissions for 2017, 2020, 2023 and 2026 were interpolated between 2014 and 2028.						

Table 4-6: Onroad Emissions of Primary $PM_{2.5}$ by County

	Primary PM2.5					
	2014	2017	2020	2023	2026	2028
	----- tons/year -----					
Anderson	48.13	41.36	34.59	27.82	21.05	16.54
Blount	49.40	43.66	37.92	32.18	26.43	22.61
Knox	292.10	252.62	213.14	173.66	134.18	107.86
Loudon	52.17	44.73	37.29	29.85	22.40	17.44
Roane	2.98	2.52	2.06	1.59	1.13	0.82
Grand Total	444.78	384.89	324.99	265.10	205.21	165.28
Note: Emissions for 2017, 2020, 2023 and 2026 were interpolated between 2014 and 2028.						

Table 4-7: Onroad Emissions of Sulfur Dioxide by County

	Sulfur Dioxide (SO2)					
	2014	2017	2020	2023	2026	2028
	----- tons/year -----					
Anderson	8.13	7.14	6.15	5.16	4.17	3.51
Blount	11.50	9.99	8.48	6.97	5.46	4.45
Knox	54.93	48.18	41.43	34.68	27.93	23.43
Loudon	8.35	7.46	6.58	5.70	4.81	4.22
Roane	0.48	0.43	0.38	0.33	0.28	0.24
Grand Total	83.39	73.20	63.02	52.84	42.65	35.86
Note: Emissions for 2017, 2020, 2023 and 2026 were interpolated between 2014 and 2028.						

Table 4-8: Onroad Emissions of Volatile Organic Compounds by County

	Volatile Organic Compounds					
	2014	2017	2020	2023	2026	2028
	----- tons/year -----					
Anderson	839.40	729.91	620.42	510.94	401.45	328.46
Blount	1,199.70	1,043.66	887.62	731.59	575.55	471.53
Knox	3,446.93	2,989.33	2,531.73	2,074.13	1,616.53	1,311.47
Loudon	617.51	542.35	467.19	392.03	316.87	266.76
Roane	19.03	16.12	13.21	10.30	7.39	5.45
Grand Total	6,122.57	5,321.37	4,520.18	3,718.99	2,917.79	2,383.66
Note: Emissions for 2017, 2020, 2023 and 2026 were interpolated between 2014 and 2028.						

4.1.4 Attainment Year and Projected Emissions Inventory Summary

Summaries of attainment year and projected emissions inventories for the entire Knoxville nonattainment area are presented in Tables 4-9 through 4-13.

Table 4-9: Total Nonattainment Area NO_X Emissions by Sector

	Point	Nonpoint	Onroad	Nonroad	Total
	----- Oxides of Nitrogen (tons/year) -----				
2014	6,041.52	1,126.29	15,597.73	2,789.33	25,554.88
2017	5,725.54	985.98	13,232.05	2,567.57	22,511.14
2020	6,134.99	982.48	10,866.37	2,490.86	20,474.69
2023	6,217.20	977.19	8,500.68	2,560.11	18,255.18
2026	6,303.95	976.34	6,135.00	2,791.12	16,206.41
2028	6,336.33	977.04	4,557.88	3,230.56	15,101.81

Table 4-10: Total Nonattainment Area $PM_{2.5}$ Emissions by Sector

	Point	Nonpoint	Onroad	Nonroad	Total
	----- Primary PM2.5 (tons/year) -----				
2014	1,129.70	1,772.14	444.78	194.60	3,541.21
2017	1,081.26	1,804.53	384.89	169.64	3,440.31
2020	1,165.20	1,856.91	324.99	152.38	3,499.48
2023	1,184.98	1,913.79	265.10	144.52	3,508.39
2026	1,205.31	1,966.42	205.21	143.46	3,520.40
2028	1,211.30	2,005.01	165.28	149.23	3,530.82

Table 4-11: Total Nonattainment Area SO_2 Emissions by Sector

	Point	Nonpoint	Onroad	Nonroad	Total
	----- Sulfur Dioxide (tons/year) -----				
2014	4,146.99	30.10	83.39	47.17	4,307.65
2017	3,125.61	35.25	73.20	58.23	3,292.29
2020	3,420.16	36.67	63.02	77.81	3,597.65
2023	3,454.73	37.40	52.84	107.89	3,652.86
2026	3,499.37	37.93	42.65	153.67	3,733.63
2028	3,514.63	37.98	35.86	222.93	3,811.40

Table 4-12: Total Nonattainment Area VOC Emissions by Sector

	Point	Nonpoint	Onroad	Nonroad	Total
	----- Volatile Organic Compounds (tons/year) -----				
2014	2,944.28	8,869.86	6,122.57	2,340.70	20,277.41
2017	3,454.23	8,889.45	5,321.37	2,001.12	19,666.17
2020	3,814.52	9,000.92	4,520.18	1,794.24	19,129.86
2023	4,039.05	9,116.64	3,718.99	1,741.57	18,616.23
2026	4,251.65	9,239.75	2,917.79	1,766.53	18,175.73
2028	4,380.02	9,309.98	2,383.66	1,863.80	17,937.46

Table 4-13: Total Nonattainment Area NH_3 Emissions by Sector

	Point	Nonpoint	Onroad	Nonroad	Total
	----- Ammonia (tons/year) -----				
2014	90.58	1,113.99	305.40	2.77	1,512.74
2017	88.83	1,166.32	296.59	2.82	1,554.57
2020	91.19	1,205.32	287.78	2.89	1,587.18
2023	92.69	1,234.43	278.97	2.96	1,609.05
2026	93.37	1,244.01	270.16	3.04	1,610.57
2028	93.56	1,253.67	264.29	3.09	1,614.61

The projected 2028 inventories for NO_X, $PM_{2.5}$, SO_2, and VOC are all less than the base year emissions. NO_X emissions are projected to decrease by 10,453 tons. $PM_{2.5}$ emissions are projected to decrease by 10.39 tons. SO_2 emissions are projected to decrease by 496 tons. VOC emissions are projected to decrease by 2340 tons. Ammonia emissions are projected to increase slightly by 101.87 tons.

4.1.5 Motor Vehicle Emissions Budget (MVEB)

Onroad mobile source emissions were projected using a combination of output from a number of computer programs that predict mobile emission factors and traffic volumes. These traffic volume projections and emissions projections are discussed in more detail in Appendix K.

The annual vehicle miles traveled (VMT) were developed by TDOT from measured HPMS data for 2014. VMT projections for 2028, based on data provided by the Knoxville Regional Transportation Planning Organization, are presented earlier in Table 4-2. Further discussion is included in Appendix K.

Detailed information on MOVES inputs are contained in Appendix K. Onroad emissions totals by county are summarized, in Tables 4-4 through 4-8, which illustrate significant reductions of all emissions from onroad mobile sources projected to occur between 2014 and 2028.

The Transportation Conformity Rule, in 40 CFR Part 93.102(b)(2)(iv) through 93.102(b)(3) addresses various precursor pollutants from onroad sources that may be applicable in $PM_{2.5}$ nonattainment and maintenance areas. A number of pollutants and pollutant precursors have been considered for their significance relative to the establishment of a motor vehicle emissions budget. In this consideration, some of the published information on these pollutants and pollutant precursors was weighed in helping make a determination of significance, as well as the reductions in emissions over time and the overall contribution from onroad mobile sources.

Oxides of Nitrogen (NO_x): Neither the EPA nor the State have made a finding that NO_x from onroad sources are not a significant contributor to $PM_{2.5}$ nonattainment. Thus a MVEB for NO_x will be established in this maintenance plan.

Volatile Organic Compounds (VOC): The Air Pollution Control Division (APCD) has examined the sources of VOC emissions and their contribution to $PM_{2.5}$ in the Knoxville Nonattainment Area. Due to the generally warm and moist climate of Tennessee, vegetation abounds in many forms, and forested lands naturally cover much of the State. The biogenic sector is the most abundant source of VOC emissions in Tennessee and accounts for the majority of these emissions.

The APCD believes onroad mobile source VOCs are insignificant contributors to $PM_{2.5}$ formation in the Knoxville nonattainment area. Onroad mobile source VOC emissions are projected to decrease into the future, despite VMT increases. For these reasons, the APCD presented the VOC insignificance concept to the transportation partners and all agreed through interagency consultation that VOC emissions from onroad mobile sources are insignificant contributors to the $PM_{2.5}$ nonattainment issues in the Knoxville Area. Therefore, the APCD will not set a MVEB for VOCs for the Knoxville Nonattainment Area.

Sulfur Oxides (SO_x): Sulfur oxides are mostly emitted from the combustion of fossil fuels in boilers operated by electric utilities and other industry. Less than about 20 percent of SO_2 emissions nationwide are from other sources, mainly other industrial processes such as oil refining and pulp and paper production. APCD believes current sulfur dioxide emissions from motor vehicles would not necessitate a budget due to the insignificant levels of sulfur dioxide emissions from onroad vehicles, and considering that sulfur dioxide emissions from onroad sources have declined significantly in the recent past due to the implementation of requirements for low-sulfur gasoline (which began in 2004) and for low sulfur diesel fuel (which began in 2006). As discussed earlier, Tier 3 emissions standards for light duty passenger cars and trucks, beginning in 2017, will require lower sulfur content in gasoline. Therefore, there will not be a motor vehicle emissions budget set for SO_x.

Ammonia (NH_3): APCD has determined that ammonia from onroad sources do not contribute significantly to $PM_{2.5}$ nonattainment issues in the Knoxville Nonattainment Area.

Road and Construction Dust: The APCD agrees with EPA's assessment in the July 1, 2004 Federal Register: *Transportation Conformity Rule Amendments for the New 8-hour Ozone and $PM_{2.5}$ National Ambient Air Quality Standards and Miscellaneous Revisions for Existing Areas; Transportation Conformity Rule Amendments: Response to Court Decision and Additional Rule Changes: Final Rule* where EPA states on page 40034 that evidence suggests that re-entrained road dust is likely to have a relatively small impact on $PM_{2.5}$ compared to PM_{10} in general. Further in the same rule, on page 40036 EPA states that, "…construction dust will not be significant in all areas…" APCD agrees that road and construction dust is not a significant concern in Tennessee.

Thus, after careful consideration and consultation with the Interagency Consultation Group, the APCD is electing to only set motor vehicle emissions budgets for $PM_{2.5}$ and Oxides of Nitrogen (NO_x).

Between 2014 and 2028 onroad emissions of NO_x in the nonattainment area, are projected to decrease over seventy percent. Substantial reductions, over 60 percent, in onroad $PM_{2.5}$ are projected to occur between 2014 and 2028. These substantial reductions in oxides of nitrogen and $PM_{2.5}$ are largely attributable to the Environmental Protection Agency's (EPA) Federal Motor Vehicle Control Programs.

The emissions projections for $PM_{2.5}$ in Table 4-10 indicate emissions in 2028 for the region will be approximately 10 tons/year less than they were in 2014. Much of this decrease in projected emissions is reflective of the implementation of a number of state and federal control measures mentioned earlier. More significant reductions are expected for NO_x during this same period: a decrease in emissions of over 40 percent.

The reduction of $PM_{2.5}$ over the maintenance period of 10 tons, however, does not allow for an adequate safety margin for unexpected or unanticipated changes in planning assumptions or emissions rates from onroad mobile sources. A transportation conformity demonstration requires an analysis of the emissions from the transportation network in the nonattainment or maintenance area. These emissions must be compared against an emissions limit, or motor vehicle emissions budget (MVEB) that is established in this maintenance plan. These determinations are made by the Knoxville TPO. This is accomplished through the use of several models, including a travel demand forecasting model and an emissions factor model (in this case EPA's MOVES model). These models and the data used to populate the inputs of these models, change over time. For example, the transition from EPA's onroad emissions factor model MOBILE to MOVES resulted in more than a doubling of $PM_{2.5}$ emissions for the same year of analysis, using the same model inputs. Similarly, oxides of nitrogen increases were nearly fifty percent higher; again, using the same model inputs.

Metropolitan planning organizations in nonattainment and maintenance areas subject to transportation conformity must update their travel demand model no less frequently than every four years. These updates result in not only changes to the underlying data like population and economic growth, but also to the underlying travel demand model equations and forecasting methods.

The Clean Air Act does not allow for a timely process to alter motor vehicle emissions budgets in response to changes in planning assumptions that do not change actual emissions emitted to the air. The time it would take to revise a MVEB, from start to effective date can range from six months to two years. If an MPO needed a revised motor vehicle emissions budget (MVEB) for whatever reason, that MVEB might need to be revised in no more than two months. Due to this inherent incongruity between the CAAs requirements for MVEBs and demonstrating conformity, the need for a safety margin is necessary to avoid circumstances where calculated emissions increase significantly without the respective change in emissions emitted by automobiles on the road.

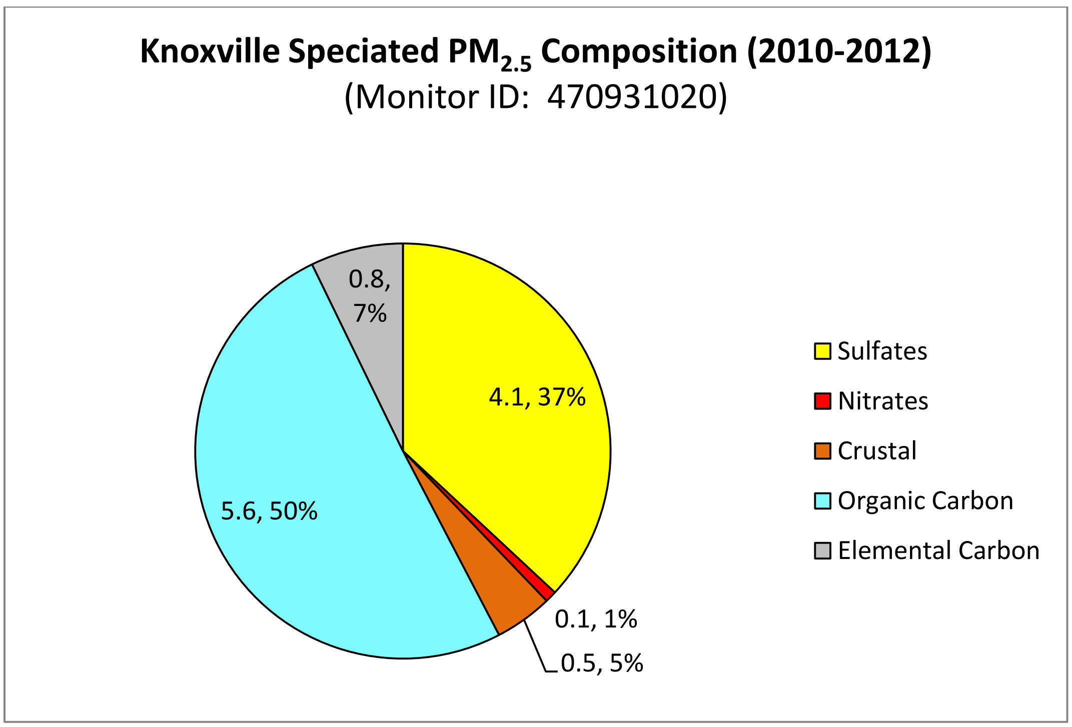
In conjunction with the Knoxville TPO, a 'worst-case' scenario was developed to estimate the potential emissions increases due to changes in models and planning assumptions. An analysis year of 2045 was selected. In addition, projected VMT was increased by 10%, the age of the fleet was increased by approximately two years, and the source type (vehicle) population was increased by 10% above the projected source type population for 2045. This analysis yielded emissions of $PM_{2.5}$ from onroad sources of about 80 tons/year above those projected from onroad sources in 2028. Since the existing safety margin of about 10 tons/year is being added to the MVEB, a difference of about 70 tons/year remains.

Although onroad emissions of $PM_{2.5}$ in the Knoxville Area decrease about 10 tons from 2014 through 2028, an additional seventy tons of direct $PM_{2.5}$ may be necessary for the development of a safety margin to address the concerns expressed above. The 80 tons/year safety margin added to the onroad $PM_{2.5}$ emissions inventory for 2028 would result in onroad emissions of approximately 245 tons/year $PM_{2.5}$ from the onroad sector in 2028. The overall rise in total $PM_{2.5}$ emissions from approximately 3,541 tons/year in the base year, 2014, to 3,610 tons/year in 2028 is equal to approximately a 2.0% increase of attainment year $PM_{2.5}$ emissions.

To understand the potential impact of a 2.0% emission increase in direct $PM_{2.5}$ on future air quality, APCD analyzed the relationship between $PM_{2.5}$ emissions and ambient concentrations in the Knoxville area. A similar approach was used by the EPA in its evaluation and approval of the annual $PM_{2.5}$ redesignation request for the Evansville, Indiana 1997 Annual $PM_{2.5}$ Nonattainment Area (see 76 FR 29695 and 76 FR 59527) as well for the Georgia portion of the Chattanooga, 1997 Annual $PM_{2.5}$ Nonattainment Area (see 79 FR 67120 and 79 FR 75748).

Speciation data available from 2010-2012 from a Knoxville monitoring site (AQS ID: 470931020) was examined to determine the composition of fine particulate matter. The fine particulate composition was broken down into several basic groups, including: sulfates, nitrates, crustal material (mostly soil derived material), organic carbon and elemental carbon. The 3-year average of this data suggests that ambient $PM_{2.5}$ in Knoxville consists of approximately 37 percent sulfate, one percent nitrate, 50 percent organic particulate (which consists of directly-emitted primary organic matter and atmospherically formed secondary organic aerosol), 5 percent inorganic particulate, labeled "crustal" particles, and 7 percent elemental carbon. Using a conservative assumption that all of the mass associated with organic carbon, elemental carbon, and crustal material is primary, direct $PM_{2.5}$ species make up 62 percent (sum of 50 percent organic particulate, 5 percent crustal and 7 percent elemental carbon) of the total ambient $PM_{2.5}$. The remaining 38% of total fine particulate mass is comprised of sulfate and nitrates which are formed in the atmosphere through secondary processes. See Figure 4-1 below.

Figure 4-1: Speciated $PM_{2.5}$ Concentrations in Knoxville (Monitor ID: 470931020) for 2010-2012 Sampling Data Reconstructed by EPA Using the SANDWICH Technique



Using a conservative assumption that 62% of the $PM_{2.5}$ mass in the Knoxville Area is primary $PM_{2.5}$, APCD determined that increasing the $PM_{2.5}$ emission budget by an additional 70 tons/year (80 tons/year – 10 tons/year existing safety margin) in 2028 (i.e. a 2.0% increase) will not affect the Knoxville Area's ability to maintain the $PM_{2.5}$ NAAQS. Even if a conservative baseline concentration of 15.0 $\mu g/m^3$ is assumed, a 2.0% emission increase is not expected to have a large impact on ambient $PM_{2.5}$ concentrations. Per the discussion of Figure 4-1, above, direct $PM_{2.5}$ is conservatively estimated to contribute 62 percent to total $PM_{2.5}$ mass, or 9.3 $\mu g/m^3$ of the 15.0 $\mu g/m^3$. APCD's assessment assumes that the projected increase in direct $PM_{2.5}$ emissions will cause a corresponding 2.0 percent increase in ambient concentrations of

$PM_{2.5}$, which suggest an increase in the ambient concentration of the direct $PM_{2.5}$ component by 0.19 μg/m^3 (9.3 μg/m^3 *(2.0/100) = 0.19 μg/m^3). When this 0.19 μg/m^3 increase is added to the most recent $PM_{2.5}$ design value of 10.0 ug/m^3 from the 2013-2015 timeframe (see Table 2-1), the maximum ambient $PM_{2.5}$ concentration resulting from this emission increase is 10.19 μg/m$^{3.}$ This $PM_{2.5}$ concentration is well below the 1997 Annual $PM_{2.5}$ NAAQS of 15.0 μg/m^3 as well as the 2012 annual $PM_{2.5}$ NAAQS of 12.0 μg/m^3.

Furthermore, APCD believes that this potential increase will be substantially offset by a greater decrease in sulfate and nitrate concentrations. The precise decrease in sulfate and nitrate concentrations is a complicated result of emissions reductions in the Knoxville area, and nearby regions. These prior emission reductions have brought measured $PM_{2.5}$ concentrations to 10.0 μg/m^3 over the past years (as shown in Table 2-1). Therefore, the 0.19 μg/m^3 increase associated with direct $PM_{2.5}$ mass is not expected to yield total $PM_{2.5}$ concentrations above the standard. That is, APCD believes that maintenance of the annual $PM_{2.5}$ standard is demonstrated despite the small potential increase in direct $PM_{2.5}$ emissions.

Transportation Conformity, as established in the Clean Air Act, is intended to ensure that federally funded or approved transportation projects, plans or programs conform to the applicable State Implementation Plan (SIP). This requirement is achieved through the establishment of a motor vehicle emissions budget for the applicable pollutant or pollutant precursors.

Pursuant to the EPA's transportation conformity rule in 40 CFR Part 93, specific emission budgets are hereby defined for the onroad mobile sources portion of the emissions inventory. These budgets are to be used by the transportation authorities to assure that transportation plans, programs, and projects are consistent with, and conform to, the maintenance of acceptable air quality in the Knoxville area. The last year of this maintenance plan (2028) is a year which must have a defined Motor Vehicle Emissions Budget (MVEB). In addition to the establishment of a MVEB for 2028, the Knoxville Regional TPO requested an additional MVEB be established for 2014 as well. This MVEB reflects the total onroad emissions for 2014. The 2028 MVEB includes the total onroad emissions for that year, plus an allocation from the available NO_x and $PM_{2.5}$ safety margins. In addition to the available safety margin allocated to the $PM_{2.5}$ MVEB an additional 70 tons/year of $PM_{2.5}$ is added to the MVEB as described above. The allocation from the NO_x safety margin accounts for uncertainty in the projections and is available due to reductions in NO_x that are projected to occur primarily from onroad mobile sources. The available safety margins are illustrated in Table 4-14 and Table 4-15.

Table 4-14: Total Nonattainment Area $PM_{2.5}$ Emissions with Safety Margins

	Point	Nonpoint	Onroad	Nonroad	Total	Safety Margin
	----- Primary PM2.5 (tons/year) -----					
2014	1,129.70	1,772.14	444.78	194.60	3,541.21	
2017	1,081.26	1,804.53	384.89	169.64	3,440.32	100.90
2020	1,165.20	1,856.91	324.99	152.38	3,499.48	41.73
2023	1,184.98	1,913.79	265.10	144.52	3,508.39	32.82
2026	1,205.31	1,966.42	205.21	143.46	3,520.40	20.81
2028	1,211.30	2,005.01	165.28	149.23	3,530.82	10.39

Table 4-15: Total Nonattainment Area NO_X Emissions with Safety Margins

	Point	Nonpoint	Onroad	Nonroad	Total	Safety Margin
	----- Oxides of Nitrogen (tons/year) -----					
2014	6,041.52	1,126.29	15,597.73	2,789.33	25,554.87	
2017	5,725.54	985.98	13,232.05	2,567.57	22,511.14	3,043.73
2020	6,134.99	982.48	10,866.37	2,490.86	20,474.69	5,080.18
2023	6,217.20	977.19	8,500.68	2,560.11	18,255.18	7,299.69
2026	6,303.95	976.34	6,135.00	2,791.12	16,206.41	9,348.46
2028	6,336.33	977.04	4,557.88	3,230.56	15,101.81	10,453.07

Under 40 CFR 93.101, the term safety margin is the difference between the attainment level (from all sources) and the projected level of emissions (from all sources) in the maintenance plan. The safety margin, or portion of the safety margin, can be allocated to the transportation sector. A portion of the available 2028 safety margin is allocated to the NO_x MVEB, while the entire available $PM_{2.5}$ safety margin is allocated to the $PM_{2.5}$ MVEB. Specifically, 10.39 tons/year of the available $PM_{2.5}$ safety margin is allocated to the 2028 MVEB; there is no remaining safety margin for $PM_{2.5}$ for 2028. Additionally, 2,613.27 tons/year of the available NO_x safety margin is allocated to the 2028 MVEB; the remaining safety margin for NO_x for 2028 is 7,839.80 tons/year. The Motor Vehicle Emissions Budgets are contained in Table 4-16.

Table 4-16: Area-wide MVEB with Safety Margins for the Knoxville Area

	2014	2028
Pollutant	----- tons/year -----	
$PM_{2.5}$	444.78	245.00*
NO_x	15,597.73	7,171.14

*The MVEB for $PM_{2.5}$ in 2028 includes the available safety margin of 10.39 tons/year and an additional 69.33 tons/year.

For future conformity determinations, transportation authorities should rely on the above motor vehicle emissions budgets (MVEBs) unless this maintenance plan is revised.

4.2 Verification of Continued Attainment

Continued attainment of the $PM_{2.5}$ NAAQS shall be verified through operation of the existing FRM[11] monitors in the area and periodic updates to the emissions inventory. Each monitor is operated in accordance with the applicable provisions of Title 40 CFR Part 58, and all required data from the $PM_{2.5}$ FRM monitors is submitted quarterly to the US EPA pursuant to 40 CFR §58.16.

4.3 Contingency Measures

Section 175A of the CAA requires that a maintenance plan include such contingency measures as EPA deems necessary to assure that the State will promptly correct a NAAQS violation that might occur in the maintenance area after redesignation. The maintenance plan must identify the contingency measures to be considered for possible adoption, a schedule for adoption and implementation of the selected contingency measures, and a time limit for action by the State. In accordance with §175A(d) of the Clean Air Act, Tennessee will implement any measures which exist in the current State Implementation Plan for fine particulate matter. No measures in the State Implementation Plan have been discontinued or moved to contingency measures.

The two main elements of the contingency plan are triggering mechanisms to determine when contingency measures are needed and a process of developing and adopting appropriate control measures. The primary trigger of the contingency plan will be a quality assured/quality controlled violating design value (DV) of the annual $PM_{2.5}$ NAAQS at any monitor. Upon activation of the trigger, the State of Tennessee, in conjunction with the Knox County Department of Air Quality Management (DAQM), will commence an analysis to determine what additional measures will be necessary to attain or maintain the fine particulate standards. Since transport from outside the region often impacts the local monitors, an evaluation to determine the amount of local emission contribution to the high $PM_{2.5}$ days may be conducted. In addition to the primary trigger indicated above, Tennessee and Knox County DAQM will monitor regional emissions through the Air Emissions Reporting Requirements (AERR) rule. If the triennial AERR results indicate emissions that are significantly greater than those of the interim and out years projected in this maintenance plan (more than 10 percent), Tennessee and Knox County DAQM will investigate the differences and develop an appropriate strategy for addressing these differences. In addition, if ambient monitoring data indicates that a violation of the three-year design value may be imminent, Tennessee and Knox County DAQM will evaluate existing control measures to determine whether further emission reduction measures should be implemented.

Tennessee and the Knox County DAQM will implement the appropriate contingency measures needed to assure future attainment of the fine particulate NAAQS within eighteen to twenty-four months of the

11 TDEC is currently planning to replace a number of FRM monitors, including some monitors in the Knoxville nonattainment/maintenance area, with beta attenuation monitors (BAM), which will result in a change in sampling method from FRM to FEM (Federal Equivalence Method). FEM is an acceptable sampling method for $PM_{2.5}$, and assurance of continued attainment will be satisfied by FEM following replacement of any FRM monitors in the Knoxville area.

monitored violation. If determined necessary (i.e., recent, and soon to be effective, new enforceable requirements are determined to be inadequate), the adoption of rules for ensuring attainment and maintenance of the annual $PM_{2.5}$ NAAQS will begin. Tennessee commits to implement within 24 months of a triggering event, or as expeditiously as practicable, at least one of the control measures listed in Section 4.3.1 or other contingency measures that may be determined to be more appropriate based on the analyses performed.[12] The proposed schedule for these actions would be as follows:

- Six months to identify appropriate contingency measures, including identification of emission sources and appropriate control technologies;
- Between three and six months to initiate a stakeholder process; and
- Between nine and twelve months to implement the contingency measures. This step would include the time required to draft rules or SIP amendments, complete the rulemaking process, and submit the final plans to EPA.

4.3.1 Measures for Implementation as Necessary

The selection of emission control measures will be based on emission reduction potential, cost-effectiveness, economic and social consideration, and/or other factors deemed appropriate by the State. These selected measures will be subject to public review, and the State will seek public input prior to the selection of new emission control measures.

The Division has identified the following measures to be considered for possible adoption as a result of a trigger of the contingency plan:

- Additional reasonably available control technology (RACT) for point sources of $PM_{2.5}$ emissions not already covered by RACT, best available control technology (BACT), or reasonable and proper emission limitations;
- Additional reasonably available control measures (RACM) for area sources of $PM_{2.5}$;
- Additional RACT for major point sources of NO_X emissions;
- Additional RACT for minor point sources of NO_X emissions;
- Additional RACM for area sources of NO_X emissions;
- Additional RACT for major point sources of SO_2 emissions;
- Additional RACT for minor point sources of SO_2 emissions;
- Additional RACM for area sources of SO_2 emissions; and

12 If quality assured/quality controlled data indicates a violating design value for the annual $PM_{2.5}$ NAAQS, then the triggering event will be the date of the design value violation, and not the final QA/QC date. However, if initial monitoring data indicates a possible design value violation but later QA/QC indicates that a NAAQS violation did not occur, then a triggering event will not have occurred, and contingency measures will not need to be implemented.

Other control measures, not included in the above list, will be considered if new control programs are deemed more advantageous for this area.

4.3.2 Contingency Measure Triggers

The primary trigger of the contingency plan will be an exceedance of the 1997 annual $PM_{2.5}$ NAAQS (15.0 $\mu g/m^3$) at any FRM monitor in the Knoxville maintenance area, based on quality-assured and certified monitoring data as averaged over three consecutive calendar years. This will "trigger" the commitment to enact one or more contingency measures as described in Section 4.3.1. Furthermore, such an evaluation will also be triggered by the occurrence of any of the following conditions that may forewarn of a potential exceedance of the annual $PM_{2.5}$ NAAQS:

- An annual mean $PM_{2.5}$ concentration (average of quarterly-average concentrations) of **greater than or equal to 16.0 $\mu g/m^3$** for the previous calendar year at any FRM monitor in the Knoxville maintenance area, based on quality-assured and certified monitoring data;
- An annual mean $PM_{2.5}$ concentration (average of quarterly-average concentrations) of **greater than or equal to 15.5 $\mu g/m^3$** for each of the previous two calendar years at any FRM monitor in the Knoxville maintenance area, based on quality-assured and certified monitoring data;
- Total emissions of $PM_{2.5}$ in the most recent NEI for the Knoxville nonattainment area exceeding 130% of the corresponding emissions for 2014 (the attainment year);
- Total emissions of SO_2 in the most recent NEI for the Knoxville nonattainment area exceeding 130% of the corresponding emissions for 2014 (the attainment year);
- Total emissions of NO_X in the most recent NEI for the Knoxville nonattainment area exceeding 130% of the corresponding emissions for 2014 (the attainment year)

The NEI is relied upon to meet the requirements of the AERR, and it will be the primary data source for future year emissions comparisons to the maintenance plan.

5.0 RACT/RACM ANALYSIS

40 CFR 51.1009(a)(4)(i) requires a state to submit a SIP revision for each $PM_{2.5}$ nonattainment area demonstrating that the state has adopted all RACM, including reasonably available control technology for stationary sources, necessary to demonstrate attainment as expeditiously as practicable. This section of the $PM_{2.5}$ implementation rule goes on to state that "The state shall also adopt and implement all other technologically and economically feasible measures identified under paragraph (a)(3) of this section that, when considered collectively, would advance the attainment date for the area by at least 1 year.." Because the Knoxville nonattainment area has attained, and continues to attain, the 1997 $PM_{2.5}$ NAAQS, no emissions control measures would advance attainment. Therefore, no measures are necessary to satisfy CAA §172(c)(1) RACM pursuant to 40 CFR 51.1009(a)(4)(i).

Both CAA sections 172(c)(1) and 189(a)(1)(C) require "provisions to assure that reasonably available control measures" (*i.e.,* RACM) are implemented in a nonattainment area. EPA has long interpreted “reasonably available control measures” under CAA sections 172(c)(1) and 189(a)(1)(C) to mean only those measures that are necessary to help an area achieve attainment. <u>Thus, where an area is already attaining the standard, no additional RACM are required, but all measures adopted into the SIP prior to attainment would remain.</u> The EPA is interpreting CAA section 189(a)(1)(C) consistent with its interpretation of CAA section 172(c)(1).